

APPARENT TERRITORIALITY OF THE BLACK DARTER *SYMPETRUM DANAE* (SULZER), NEW TO THE NATIONAL WETLANDS CENTRE WALES

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ABSTRACT

A preliminary study was made of two male *Sympetrum danae* (Sulzer), on the day of their only recorded sighting to date, at an alkaline pond at the National Wetlands Centre Wales. Behaviour was categorised and recorded in twenty minute blocks to produce a time budget for each insect. Perch sites and perch durations were also noted. Differences between and within the time budgets of the individual males were confirmed using a G-test for homogeneity. Both had one perch site they used more frequently than others and intruders of alien species were chased away from such locations. The territory of each male was separated by a boardwalk, and therefore had no common edge. This apparent site attachment supports the view that these individuals were behaving in a territorial manner.

INTRODUCTION

Males of many species of dragonfly (Odonata) have been observed to exhibit territoriality (Corbet, 1980). Complex combinations of spatial, temporal and biological factors determine such expressions of territoriality (Parr, 1983). A territory has been defined for Odonata by Corbet (1999) as “an area occupied by an individual (or occasionally more than one individual) and defended against intruders”. Site attachment is defined as the “association over time between an individual and a particular site” (Corbet, 1999). Site attachment is positively correlated with territoriality and aggression (Parr, 1983).

The most widely accepted primary function of territoriality is to space individuals, providing the territory holder with improved access to essential resources (Kaufmann, 1983). These resources include food, protection from predators, and access to females for mating. Territoriality in the Odonata tends to occur in species with marked sexual dimorphism. Such species can visually recognise male and female conspecifics and react appropriately (Johnson, 1963). Intra-specific territoriality predominates (Moore, 1964), but inter-specific territoriality can occur when specific recognition is impossible, or when individuals of different species are competing for the same resource (Alcock, 2001).

Recent accounts of the expression of territoriality in the Black Darter *Sympetrum danae* (Sulzer) are conflicting. Michiels and Dhondt (1990) define *S. danae* as “a small non-territorial libellulid”. Brooks (2002) states that “mature males are non-territorial”, while Corbet (1999) reports that *S. danae* shows sexual selection “through mate acquisition by scramble competition”, a non-territorial form of mate selection. Subsequently, Corbet, referring to Michiels and Dhondt’s (1991) work on *S. danae*, states that “size increases mating success in non-territorial males”. In contrast, Parr (1983), in work analysing territoriality in libellulids, categorised *S. danae* as a territorial libellulid. He described the relationship between size of odonate species and the area they defend as being one in which “small species [e.g. *Sympetrum danae*] tend to defend small areas”. Merritt *et al.* (1996) describe *S. danae* as being “not strongly territorial”.

The present study provides preliminary evidence of territorial expression by *S. danae* in a single locality and on a single day.

MATERIALS AND METHODS

Recording took place on 17 September 2003 at the National Wetlands Centre Wales (NWCW). The Centre is located at OS Grid Reference SS532984 (51:39:55N, 4:07:59W) and is part of the Millennium Wetlands. It is a Site of Special Scientific Interest, based on its dragonfly population alone, a Special Area of Conservation, a Special Protected Area and a RAMSAR site (a designation for important wetland areas) (Hails, 1996). Data collected involved the first recorded incidence of *S. danae* at the site.

Observations took place at a small alkaline pool (pH 9.2) with an approximate diameter of 10m, to the north of the site. *Iris pseudocorus* (Yellow Flag Iris), *Typha angustifolia* (Lesser Reedmace) and *Juncus* spp (rushes) dominated emergent vegetation. The pool is a known breeding site for other species of Odonata (Thomas, 2002).

Behavioural Data Collection

The activity budgets of two male *S. danae* were recorded at isolated sections of the pool. Sessions were timed separately using a continuously running standard digital chronograph (with the smallest measurable unit of one-hundredth of a second). Interactions with all other odonate species were recorded, and observations for each individual continued for 20 minutes at a time. The time each bout of activity ended was recorded. Behaviour was categorised as:

Perching. Adults not flying, remaining in a place and maintaining an open view of the surroundings (Corbet, 1999). Perch duration and location were recorded. Perch sites were subsequently scored 1 to 4 (1 for the perch site at which the greatest time was spent).

Patrolling. Steady and moderately low-level flight (Corbet, 1999).

Chase types. Definitions of these encounters can be found in Corbet (1999) and Alcock (1987). They included horizontal chase, ascending flight, meet-and-turn encounters, spiral or circle flights, zigzag flight and feeding attempts.

Data Analysis

The behavioural data were recorded as a spreadsheet in Excel (2000). The activity budgets for males 1 and 2 are presented in Table 1. Percentage times allocated for each perch site in each male's area were recorded and are presented in Table 2.

The data were analysed to compare time allocated to each activity by each male, and to compare times allocated to each perch site. A G-test for homogeneity (Fowler *et al.*, 1998) was used to confirm trends statistically.

RESULTS

The data showed that both male *S. danae* devoted significantly more time to perching than to other activities (Table 1).

The time allocation of the first male differed significantly from that of the second male. The first male spent more time patrolling, which increased encounter rate and resulted in more time chasing. The second male spent less time patrolling, which to a

Table 1. Time budgets for two male *Sympetrum danae* at the National Wetlands Centre Wales, 17 September 2003.

	Total duration of each activity in seconds			
	Perch	Patrol	Chase	Feed
Male 1 (% time)	986 (82.2)	121 (10.1)	87 (7.2)	6.0 (0.5)
Mean (n)	26.0 (38)	8.1 (15)	4.0 (22)	2.0 (3)
Male 2 (% time)	1143 (95.3)	42 (3.5)	15 (1.2)	0.0 (0.0)
Mean (n)	60.2 (19)	2.6 (16)	7.5 (2)	0.0 (0)

Table 2. Percentage time spent by each male *Sympetrum danae* at scored perch sites in their respective areas.

Perch site score	% time allocated to perch sites	
	Male 1	Male 2
1	88.2	76.0
2	7.0	17.9
3	4.6	4.1
4	0.2	2.0

degree resulted in less time chasing. Only the first male was observed feeding. Both males devoted more time to patrolling than to chasing (Table 1).

Both males used a total of four perch sites during the observation period. However, they spent significantly more time at one particular perch site within each of their respective areas (Table 2).

Observations showed that the type of chase behaviour varied according to the ‘adversary’ involved. Intruders were easily identified as they were always of different species (no intra-specific encounters were noted). Chases involving aeshnid dragonflies tended to be of the ‘zigzag’, ‘meet-and-turn’ or ‘horizontal’ types, and to be the longest such events in the present study.

The first male showed mean chase durations of 5.3 seconds and 6.3 seconds when chasing *Aeshna mixta* (Latrielle) (Migrant hawk) and *Aeshna cyanea* (Müller) (Southern hawk), respectively. The second male only had encounters with *A. mixta* that resulted in a mean chase duration of 7.5 seconds of the ‘zigzag’ category. Chases involving *Sympetrum striolatum* (Charpentier) (Common darter) were of a ‘horizontal’ or ‘spiral’ nature. The mean chase duration for this species for male 1 was 3.0 seconds. Chases of lestids tended to be brief, and ‘horizontal’; the mean duration of chases for *Lestes sponsa* (Hansemann) (Emerald damselfly) was 2.1 seconds. The resident was always seen to ‘win’ every encounter observed, resulting in the ‘loser’ retreating from the area.

DISCUSSION

The first male allocated more time to chasing than the second male, as a higher incidence of intruders occurred within its home area. The second male operated in an

area that did not appear to be so desirable as an oviposition site, so that fewer intruders might be expected. This may have also resulted in this individual showing a greater tendency to move between perches, as intruders deemed no part of the area as particularly desirable. The higher frequency of chases undertaken by the first male may have necessitated feeding, as more energy would have been expended in patrolling and chasing. In contrast, the second male was more sedentary and did not feed during the observation period. Any discrepancies in the times that the two males spent at their preferred perch sites may have resulted from differences in the amount of time allocated to chasing intruders.

Both males spent most of their time perching and clearly had preferred locations. Parr (1983) defines 'perchers' as spending less than 20% of their time in the air. Males 1 and 2 spent 17.4% and 4.7% of time in the air, respectively, and therefore their behaviour fits this description of territorial male Odonata. This behaviour is not incompatible with Corbet's definition of site attachment. Basking areas favoured by other *Sympetrum* species were available in close proximity to the used perch sites, but were not used by these males.

As noted earlier, this was the only recorded sighting to date of this species at the NWCW and regrettably responses to conspecifics by these males could not be assessed. Both test males, however, rapidly responded to the presence of other species of Odonata by chasing them away from their perch sites and the area immediately surrounding them. The pond at which the recordings took place is a popular oviposition site for other species of Odonata. Species recorded using the pond included 4-Spotted chaser *Libellula quadrimaculata* (L.), Emperor dragonfly *Anax imperator* (Leach), Common darter *Sympetrum striolatum* (Charpentier) and Migrant hawk *Aeshna mixta* (Latrielle). Frantsevich and Mokrushov (1984) suggested that as *S. danae* lacks wing markings, it cannot easily distinguish inter- from intra-specific competitors. Consequently, the high population density of Odonata at the site may be perceived by this species as a high density of competitors.

Mating tactics of Odonata appear to change under varying environmental conditions (Corbet, 1999), and territoriality is known to be a 'plastic' feature in certain species of Odonata. Particular factors at the site may have enabled these two individuals to show apparent territorial behaviour. Geographic location may also alter the incidence of territoriality; *S. danae* behaving differently in different parts of its range, as environmental conditions vary. The limited numbers of observations of the behaviour of this species in only a few geographic areas of its range, and in defined circumstances, are likely to account for the varied judgements made concerning whether *S. danae* is territorial or not. The present study confirms that *S. danae* can be territorial. The precise reasons for this occurrence at this place and time remain to be determined.

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BOOK REVIEW

Invertebrati di una foresta della Pianura Padana, Bosco Della Fontana. Secondo Contributo [*Invertebrates of a Padana Plain Forest: Bosco della Fontana. Second Contribution*.] Edited by Pierfilippo Cerretti, Sönke Hardersen, Franco Mason, Gianluca Nardi, Mara Tisato & Marzio Zapparoli. Conservazione Habitat Invertebrati 3–2004. Cierre Grafica Editore, Verona, 304 pp. €12.00. ISBN 88-8314-335-3. Available from: Corpo Forestale dello Stato, Centro Nazionale per lo Studio e la Conservazione della Biodiversità Forestale, Via C. Ederle 16 a, 37100 Verona, Italy.

The National Centre for the Study and Conservation of Forest Biodiversity in Verona has been undertaking a series of studies on the invertebrates of Italy's protected areas. The first book *Invertebrates of a Padana Plain Forest: Bosco della Fontana* was published in 2002 and both describes the study site and contains a series of papers by taxonomists from home and abroad. The new volume reports on the findings of subsequent scientific surveys, and comprises nineteen individual papers plus a large number of short notes. Despite the title, the papers are mostly written in English – the few in Italian have English abstracts.

The Bosco della Fontana nature reserve is one of the last oak-hornbeam relict forests still existing on the Po plain in Lombardy. It occupies about 233 ha at an altitude of 25m asl. More than half of the papers in the volume are on different